

Claims

1. A polyurethane resin being the reaction product of at least one diisocyanate and a group of components having isocyanate reactive functional groups, said group of components comprising:
 - a) a first group of one or more polyether polyols each having an average molecular weight in the range of between 400 to 12000 g/mol,
 - b) a second group of one or more polyhydroxylated resins selected from the group consisting of hard ketonic resins, ketonic resins, polyester resins, acrylic-styrene copolymers, acrylic polyols, rosin derivatives and terpene-phenolic resins,
 - c) optionally a third group of one or more polyols each having an average molecular weight of equal or less than 800 g/mol, and
 - d) at least one amine and a reaction terminating agent,wherein the ratio of the equivalent weights of the diisocyanate to the components having isocyanate reactive functional groups is selected such that essentially all of the isocyanate groups of the diisocyanate are present as the reaction product with one of said isocyanate reactive functional groups.
2. A polyurethane resin according to claim 1 wherein the ratio of the equivalent weights of the diisocyanate to the entirety of the polyether polyols of the first group, of the polyhydroxylated resins of the second group and of the polyols of the third group is in a range of 3.6:1 to 1:1, preferably 1,5:1.
3. A polyurethane resin according to any one of the claims 1 or 2, wherein the ratio of the equivalent weights of the diisocyanate to the components having isocyanate reactive functional groups is preferably in a range of between 0.8:1 to 1.2:1, more preferably of between 0.95:1 to 1.2:1, and even more preferably of between 1:1 to 1.1 :1.
4. A polyurethane resin according to any one of the claims 1 to 3, wherein the ratio of the equivalent weights of the diisocyanate to the amines is in a range of 2:1 to

6:1, preferably in a range of between 3:1 to 6:1, and more preferably in a range of between 3:1 to 5:1.

5. A polyurethane resin according to any one of the claim 1 to 4, wherein the polyether polyols of the first group have an average molecular weight in the range of from 2000 to 6000g/mol.
6. A polyurethane resin according to claim 5, wherein the polyether polyols of the first group are selected from the group consisting of dihydroxy and trihydroxy polyether polyols.
7. A polyurethane resin according to claim 6, wherein the dihydroxy polyether polyol is selected from the group consisting of polyoxalkylene glycol, preferably a polypropyleneglycol or a polytetrahydrofuran, and a caprolactone based polyether.
8. A polyurethane resin according to any one of the claim 1 to 7, wherein the ketonic resins are polyketonic resins, for example aldehyde-ketone resins, cyclohexanone condensation products having preferably a hydroxyl number of 100-200 KOH/g, or condensation products of an aliphatic ketone with formaldehyde having preferably a hydroxyl number below 100 KOH/g.
9. A polyurethane resin according to any one of the claim 1 to 7, wherein the polyester resins are unsaturated styrene-free resins having preferably a hydroxyl number below 100 KOH/g.
10. A polyurethane resin according to any one of the claim 1 to 7, wherein the acrylic-styrene copolymers are hydroxy-functional copolymers having preferably a hydroxyl number between 50 and 150 KOH/g.
11. A polyurethane resin according to any one of the claim 1 to 7, wherein the acrylic polyols are resinous polyols having a hydroxyl number between 100 and 200 KOH/g.

12. A polyurethane resin according to any one of the claim 1 to 7, wherein the terpene-phenolic resins have a hydroxyl number between 100 and 200 KOH/g.
13. A polyurethane resin according to any one of the claims 1 to 12, wherein the polyols of the third group are selected from the group consisting of monomeric diols, dihydroxy polyether polyols, polyester polyols and hard ketonic resin, wherein the hydroxy value of the hard ketonic resin is preferably in a range of between 100 mg KOH/g to 500 mg KOH/g and the hydroxy value of the polyester polyol is at least 140 mg KOH/g.
14. A polyurethane resin according to any one of the claims 1 to 13, wherein the amine is a diamine, preferably selected from the group consisting of isophoronediamine, m-xylene, 1,3 bis (aminoethyl) cyclohexane.
15. Process for preparing a polyurethane resin according to any one of claims 1 to 14, said process comprising the steps of:
 - a) first reacting a mixture comprising: a first group of one or more polyether polyols each having an average molecular weight in the range of between 400 to 12000 g/mol, a second group of one or more polyhydroxylated resins selected from the group consisting of hard ketonic resins, ketonic resins, polyester resins, acrylic-styrene copolymers, acrylic polyols, rosin derivatives and terpene-phenolic resins, and optionally a third group of one or more polyols each having an average molecular weight of equal or less than 800 g/mol, with at least one diisocyanate to an isocyanate terminated prepolymer, the ratio of the equivalent weights of the diisocyanate to the entirety of the polyether polyols of the first group, of the polyhydroxylated resins of the second group and of the polyols of the third group is in a range of 3.6 : 1 to 1 : 1, and
 - b) in a second step reacting said isocyanate terminated prepolymer with at least one diamine, and
 - c) in a third step reacting the product obtained according to step b) with a terminating agent to a saturated polyurethane resin.

16. Polyurethane resin, obtainable by the process according to claim 15.
17. A coating composition, preferably printing ink, comprising a solvent and at least one polyurethane resin according to one of the claims 1 to 14 or 16 as film forming binder.
18. Use of a polyurethane resin according to claims 1 to 14 or 16 as at least one film forming binder in printing inks for printing plastic substrates, preferably polyolefinic plastic substrate.
19. Method of producing a laminate carrying a printed layer, said method comprises the steps of
 - a) providing a coating composition, preferably a printing ink, according to claim 17;
 - b) applying a layer to a first substrate, preferably a plastic foil, by printing said printing ink of step a) in a flexographic and/or gravure printing process;
 - c) removing said solvent from said layer thereby drying and/or curing said layer obtained in step b),
 - d) applying an adhesive to the dried and/or cured layer obtained in step c) and producing the laminate by applying at least a second substrate, preferably a plastic foil, on the adhesive.
20. Laminate produced by the method of claim 19.